

Nucleonica Training Course

Nuclear Power in Space, Tomaz Žagar

Exercises

Exercise 1

Calculate specific power for different radioisotope materials considered as heat sources in RTG applications (Pu-238, Am-241, Cs-137, Co-60). The data and forms of these isotopes are given in the table.

Material	Material form	Isotope	Isotope Enrichment	Final Material Density [g/cm ³]
PuO ₂	Ceramic	²³⁸ Pu	84 wt% Pu-238, 14 %Pu-239, 2% Pu-240	10.0
AmO ₂	Ceramic	²⁴¹ Am	100 wt% Am-241	10.5
CsCl	Salt	¹³⁷ Cs	35 wt% Cs-137	3.2
Cobalt	Metal	⁶⁰ Co	10 wt% Co-60	8.8

Modules: Nuclide Datasheet, Decay Engine, Nuclide Mixtures

Exercise 2

What is the approximate energy of solar electrons needed to penetrate 1 cm and 4 cm of aluminium shielding? Calculate kinetic energy of electrons with approximate range (CSDA Range) slightly over 1 cm and 4 cm respectively.

Module: Range & Stopping Power

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Solution 1

⁶⁰Co, Datasheet: isotopic power 17,4 W/g, 10% enr. = **1.74 W/g**

CsCl, DecayEngine Cs-137: isotopic power 0.417 W/g,
35% enr, Molar Mass factor $137/(137+35.5) = \mathbf{0.116\ W/g}$

Am, Datasheet: isotopic power 0.114 W/g, Molar Mass factor $241/(241+2*16) = \mathbf{0.1006\ W/g}$

Pu, Nuclide Mixture, Decay Engine: isotopic power 0.472 W/g,
Molar Mass factor $238.2/(238.2+32) = \mathbf{0.416\ W/g}$

Solution 2

CSDA Range for 5 MeV electrons is 1.13 cm

CSDA Range for 21 MeV electrons is 4.06 cm